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STUDIES AND RESEARCHES CONCERNING THE ADAPTATION OF GENERAL PURPOSE PLOWS AT TILLING WITHOUT OVERTURNING TILING

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Keywords: soil, plants, plow, fuel consumption

ABSTRACT

The basic works of soil determine physical and biochemical changes in the soil, which favors the development of plants. Of agricultural mechanized works, the work of soil mobilization represent the main consumer of energy. Due to the high specific consumption per unit area and also of the high volume of work performed, fuel consumption represents up to 30...35% of total energy consumption. Thus, in the last period have been identified different solutions for reducing fuel consumption, such as: system with minimal work; establishment of crops in the rough land; creating new types of machines and components for tillage etc.

For this purpose, to ensure tillage without overturning tiling there has been achieved a series of changes to general purpose ploughs, particularly to variable-width plows P 2VA.

INTRODUCTION

Under conditions of low humidity, soil should be mobilized without the overturning of the tiling. For this purpose were achieved a series of studies and researches, which relates to the mobilization of ground without overturning tiling (Cojocaru I. and colab., 2005).

Among these we present a technical solution, that can be applied to general purpose plows, especially in the case of plows with variable working width. For this purpose were used an actively raising organ (used for surface soil aeration during, at PCV-1,8 plows) (Alexandru T., and M. Glodeanu, 2005).

Then is removed from support the active organ of the P 2VA plow and it will mounted on the same support the raising body, that will have an angle of penetration into the soil of 30^0 (fig. 1).

Fig.1. P 2VA plow equipped with raising organs.

Also the working width is increased at maximum to the plow that transformation has been carried out (distance between supports of active bodies being 67 cm) (fig. 2).

Fig. 2. Layout mode of the raising bodies.

MATHERIALS AND METHODS

Taking into account the potential energy of the tractor used in the experiments it was found that the maximum depth of tillage was 35 cm. In this case the width value was 140 cm. Measurements have shown a value of working width of 120 cm, for a depth of tillage of 18...20 cm.

Experiments with this type of active organ (which processes the soil without overturning tiling) were performed on a reddish-brown soil (fig.3). The work performed was analyzed in comparison with the classical method of mobilization of soil (achieved with PP 3-30 plow).

Taking to account that the mobilization of soil was carried out with or without the overturning of tiling, qualitative indices can not be compared directly. In order to achieve this objective of preparing the seedbed with disc harrows. the seedbed preparation was made with disc harrows (Ciulu Gh. And colab., 1986).

The main quality index of disc harrows is represented by the degree of grinding of the soil. For its determination it was delimited a sample of soil with the dimensions of 1 mX1 m (Cojocaru I. and colab., 2005).

In this sample were separated soil fractions with dimensions greater than 50 mm, or larger size fractions, of 50 mm.

Degree of grinding is the proportion of the weight of the soil fractions with satisfactory grinding (with dimensions of lumps not more than 50 mm) reported at the total mass of the soil sample (Cojocaru I. and colab., 2005).

Degree of grinding is calculated according to the relationship:

$$G_M = \frac{\sum_{i=1}^{n} \frac{M_{ci}}{M_{ti}}}{n} \cdot 100[\%] \quad (1)$$

where: M_{ci} is the measured weight lumps of soil with conventional maximum size less than 50 mm (from sample soil) in kg;

M_{ti} - the measured weight of the all soil samples;

n – number of samples.

Measurement operation was made with a portable scale (with a relative permissible error of 1%).

Fig.3. Aspects of work.

RESULTS AND DISCUSSIONS

In table 1 are shown the main indices of productivity and consumption, obtained for a work depth of 18...20 cm, respectively of 28...35 cm, for both variants. Soil humidity was 11,5% at a depth of 10 cm.

Table 1

Main indices of productivity and consumption obtained for soil mobilization

Indices of productivity and consumption		Variant of soil mobilization (unit)			
		classical work of plowing (U 650M+PP 3-30)		Tilling without overturning tiling (U 650M+adapted P2VA)	
Work depth (cm)		19,20	29,7	22,7	35,60
Work width (m)		0,897	0,882	1,20	1,40
Work speed (km/h)		7,21	2,51	7,18	5,32
Effective work capacity W_{ef}	**ha/h**	0,631	0,163	0,854	0,745
	%	100,00	100,00	135,3	457,00
Fuel consumption	**l/ha**	18,72	132,81	12,27	16,52
	%	100,00	100,00	65,50	50,35

It can observed that at the working depth of 18...20 cm is ensured a greater productivity with 35.5%, with a lower fuel consumption (with 34.5%) compared with the classical variant. Also It can observed that at the working depth of 28...35 cm is ensured a greater productivity with 35.7%, with a lower fuel consumption (with 40.65%). In this case it can observed a significant increase in work speed (compared with the classical variant).

The results of the tests have confirmed that the use of the active body raising claw type (at tilling without overturning tiling) is more advantageous than using classic plow (under conditions of low humidity).

In table 2 are presented data files recorded at the three types of soil mobilization.

From the data obtained results that at a humidity of soil processing of 11,5%, by processing with disc harrows (after one pass) is obtain a adequate value of grinding degree at seedbed preparation (80%).

At all variants of the soil mobilization the differences concerning the value of the grinding degree are insignificant.

Table 2

Soil grinding degree

Variant of soil mobilization (unit)	Soil grinding degree (%)	
	After processing with disc harrows	Technical requirements imposed
Classical work of plowing (U 650M+PP 3-30)	81,50	> 80
Tilling without overturning tiling (U 650M+adapted P2VA)	82,70	
processing with disc harrows (after one passes)	82,60	

In table 3 are shown the values of production obtained from the cultivation of wheat (Şimnic wheat variety), as well as those of specific fuel consumptions and workmanship, according to the variant of soil mobilization. The depth of soil mobilization, with or without overturning tiling was 18…22 cm. Seedbed preparation was done at a depth of 8…12 cm.

Fuel consumption per unit of the product was registered only for the work mobilization of soil and for the seedbed preparation.

Table 3

The influence of soil mobilization method on wheat production, specific workmanship and fuel consumption

Determined indices		Method of soil mobilization		
		Work of plowing+ Seedbed preparation with disk harrows	Tilling without overturning tiling + Seedbed preparation with disk harrows	Seedbed preparation with disk harrows (two passes)
Average production	t/ha	2,50	3,42	3,07
	%	100,00	105,23	94,96
Specific workmanship consumption	h/t	0,568	0,511	0,489
	%	100,00	89,96	86,09
Specific fuel consumption	l/t	5,76	3,59	4,36
	%	100,00	62,32	75,69

It is found that between the obtained productions there is not significant differences (the production being with 5,23% greater at the mobilization of soil with adapted plow P2 VA and reduced with 5,54% in the case of by processing with disc harrows, through two repeated passes).

The specific consumption of workmanship is more decreased at soil processing with adapted plow P2VA and also at variant of processing with disc harrows (through two repeated passes), having values of 89,96%, respectively 86,09%.

Specific fuel consumption had the lowest value at tilling without overturning tiling (with 37,68% lower, compared to the mobilization of soil with the overthrow of tiling and with 13,37% in relation to processing with disc harrows).

CONCLUSIONS

1. The implementation of this technical solution for general purpose plows allows to use them successfully to tillage without overturning tiling.

2. Analysis of the obtained results in the course of the tests, at the processing of soil with and without overthrow tiling shows the following:

- The use of raising organs ensures equal yields compared to classical work of plowing, providing in the same time a lower specific fuel consumption;

- Obtained qualitative indices of the work shows that the use of the P2VA adapted plow ensures proper processing of the soil;
- The experienced can ensure processing of soil at a depth of 35 cm, depending on the energy possibilities of the used tractor.

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THE ANALYSIS OF THE EXPERIMENTAL RESULTS AND OPTIMIZATION OF SEEDBED PREPARATION WITH WINTER WHEAT CROP

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Keywords: optimization, technology, seedbed

ABSTRACT

The paper presents experimental results and the optimization of several variants for seedbed preparation for winter wheat crop. There are taken into account six technological variants for seedbed preparation and there were studied, after sowing, the soil penetration resistance and soil structural aggregates water stability as well as the fuel consumption per hectare, the yield and there were made recommendations on the best options for conservative tillages.

INTRODUCTION

The optimization of the working process of the agricultural machineries represents an important issue within the overall farm management, either small or large surfaces. The optimization, as a subject, is present both in mechanical works as well as in areas that do not assume mechanization as crop repartition, optimal alternation of crops, the optimization of water, gases and electricity nets, the optimization of product distribution nets, profit maximization, etc. Nevertheless, one way or another, the mechanical processes are present, more or less, in all optimization processes. In determining the surfaces there are accounted the mechanization requirements in order to minimize the consumed energy for distribution and transport.

The optimization of the working processes of the agricultural machineries is a major component even though the optimization parameters are different (the width and the length of the plots, the working speed, etc.) the final objectives are, the same, the ones of energetically domain of the working processes of machineries: the specifically energy consumption per surface unit, the fuel consumption per surface unit, the working capacity or their combinations.

Material and method

In order to establish the conservative tillage for winter wheat crop there were use already used machinery that complies with the required conditions.

For solving these problems there were proposed several mechanization variants of tillage and winter wheat seedbed preparation. These variants have been tried in order to establish which one of them is suitable in the highest degree for the concept of sustainable agriculture concept and ensure, firstly, the conservation and recovery of agricultural land. For this purpose, every variant of mechanization that includes unconventional technologies, the preserves the soil, that are performed by adequate machineries, will be compared with the control variant, where the classic technology will be applied, conventional for soil tillage yet the comparison will be made with other technologies, too.

Each variant of mechanical technology will comprise the tillage performed with the winter wheat crop and the machineries used for it. Here is the case for base tillage, shallow tillage for furrow and the seedbed preparation. Seldom, yet, tillage are reduced till total disparition of them, as the case of direct drilling (in stubble, in no till soil or unplowed soil).

As most of experimented technologies include combined, complex machineries with sowing equipments, there was established that the sowing work will be presented with all technologies, so that they could be compared between.